CLAIMS

1 1. An antenna structure comprising:

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at least one antenna element, the at least one antenna element having at

least one taper; and

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a symmetrical ground plane coupled with the at least one antenna

element.

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1 2. The antenna structure of Claim 1, wherein the at least one antenna

2 element comprises a travelling wave antenna supporting a phase velocity

3 greater than the speed of light.

1 3. The antenna structure of Claim 1, wherein the taper comprises a linear

2 profile, a linear constant profile, a broken-linear profile, an exponential profile,

an exponential constant profile, a tangential profile, a step-constant profile, or a

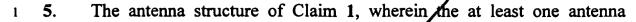
4 parabolic profile.

1 4. The antenna structure of Claim 1, wherein the antenna structure supports

2 a cigar-like directional three-dimensional beam pattern and a butterfly wing-

3 like directional three- dimensional beam pattern.





- 2 element is positioned at an angle from the symmetrical ground plane.
- 1 6. The antenna structure of Claim/5, wherein the angle is about 90 degree
- with respect to the x-, y- and z- axes
- 7. The antenna structure of Claim 1, wherein the at least one antenna
- 2 element is coupled with the symmetrical ground plane by means of an
- 3 unbalanced impedance.
- 1 8. The antenna structure of Claim 7, wherein the unbalanced impedance
- 2 comprises a coaxial cable.
- 1 9. The antenna structure of Claim 7, wherein a first conductor of the
- 2 unbalanced impedance mechanically couples the at least one antenna element
- with the symmetrical ground plane.
- 1 10. The antenna structure of Claim 1, wherein the symmetrical ground plane
- 2 is disk shaped.

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An antenna structure comprising: 11.

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an array of at least two antenna elements, each antenna element having 3 at least one taper;

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a symmetrical ground plane; and

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an unbalanced impedance for coupling the array of at least two antenna 8 elements with the symmetrical ground plane. 9

The antenna structure of Claim 11, wherein at least one antenna element **12**. 1

of the array comprises a travelling wave antenna supporting a phase velocity 2

greater than the speed of light. 3

13. The antenna structure of Claim 11, wherein the taper of at least one 1

antenna element of the array comprises a linear profile, a linear constant 2

profile, a broken-linear profile, an exponential profile, an exponential constant

profile, a tangential profile, a step-constant profile, or a parabolic profile. 4

The antenna structure of Claim 11, wherein each antenna element of the 14. 1

array supports a cagar-like directional three-dimensional beam pattern and a 2

butterfly wing-like directional three-dimensional beam pattern. 3



- 2 array is positioned at an angle from the symmetrical ground plane.
- 1 16. The antenna structure of Claim 15, wherein the angle for each antenna
- element is about 90 degree with respect to the x-, y- and z- axes.
- 1 17. The antenna structure of Claim 11, wherein the unbalanced impedance
- 2 comprises a coaxial cable.
 - 18. The antenna structure of Claim 17, wherein a first conductor of the unbalanced impedance mechanically couples each antenna element of the array with the symmetrical ground plane.
- 1 19. The antenna structure of Claim 11, wherein the symmetrical ground 2 plane is disk shaped.
- 1 20. The antennal structure of Claim 11, further comprising a slow wave
- 2 antenna to widen the directivity of the antenna structure.

- The apparatus of Claim 21, wherein the at least one antenna element
- supports a cigar-like directional three-dimensional beam pattern and a butterfly
- wing-like directional three-dimensional beam pattern. 3
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- The antenna structure of Claim 21, wherein the angle is about 90 degree 23.
- with respect to the x-, y- and z- axes.

- Peterson 18
- 24. The antenna structure of Claim 21, wherein the unbalanced impedance 1
- comprises a coaxial cable. 2



- The antenna structure of Claim 21, wherein a first conductor of the **25**. 1
- unbalanced impedance mechanically couples the at least one antenna element 2
- with the symmetrical ground plane. 3